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IMAGE CLASSIFICATION USING NEURAL NETWORK

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ABSTRACT

In this paper, we propose a method for classification of texture images using neural network. We compared the classification result with minimum distance classifier. Most of the significant information of texture is often present in high frequency channels. So these high frequency channels are decomposed repeatedly up to fourth level to extract features like mean, energy, entropy and variance. For this 8 samples are used from brodatz album and results show that the percentage classification rate is improved significantly.

KEYWORDS: Fourth Level Decomposition, Image Classification, Neural Networks

INTRODUCTION

Digital image processing involves changing the nature of an image in order to either

- More suitable for autonomous machine perception.
- To improve its pictorial information for human reception.

Image classification is the most important part of digital image analysis. It is very nice to have an image showing a magnitude of colors, illustrating the feature of image. The human brain picks the general structure of the variation in image which allows it to classify them. These general structure are not the local properties of image they represent the global properties. The classification of images is to classify the images into a limited numbers of classes. Classification approach can also be implemented to distinguish one or more specific classes of image for subsequent digital operation or detailed visual interpretation. Formally the intent of classification process is to categorize the entire pixel in digital image into one or several classes.

In the case of image classification, because of the image size involved, it is essential to extract the features of the image. The pattern or image is then classified on the basis of the features extracted. Thus it is very important to select a small number of features that represents the image uniquely and contains most discriminatory information for robust classification. Major steps involved in image classification are 1) Preprocessing. 2) Training – Selection of particular feature which describes the best pattern 3) Decisions – The choice of suitable method for comparing the image patterns with the target patterns. 4) Classified image.

Need for Classifying the Images

- Extremely powerful home PCs and the growth of the Internet have made the appearance of multimedia documents as common sight in the computer world. This data composed of several images and other media types, classification is used for classifying these multimedia images
- For remotely sensed data, In order to produce a high accuracy map of the earth's surface, the classification process, in remote sensing, assigns each pixel to its appropriate category of the real-world.

- Because of the high-quality digital cameras and the accessibility of internet photo sharing sites, many databases having billions of images are recently available. Image database classification has catch interest of researchers particularly in the computer field
- The use Automated Fingerprint Identification Systems (AFIS) are gradually increase. However, an efficiency of verification problem still exists while matching a fingerprint to all registered fingerprint images especially when the database is large. In current Automated Fingerprint Identification Systems, classification of fingerprints for improvement of efficiency verification is proposed. This involves the advance classification of fingerprint patterns into multiple classes based on fingerprint minutiae.
- Magnetic resonance imaging is an advanced medical imaging technique that has proven to be an effective tool in the study of the human brain. The rich information that MR images provide about the soft tissue anatomy has dramatically improved the quality of brain pathology diagnosis and treatment.

Literature Survey

S. Ali, S. Dey and K. Sharma [1] implemented the classification of texture and segmentation of applied image using back propogation algorithm. Stephen karuguru, Keliji [2] proposed a system that classifies fingerprint image into individual classes. They used bitmap images of 640*480 pixel size, and having 256 grayscale levels. The number of image per person is 10, and 22 peoples in database. And they got the result 93.3% using fisher linear Discrimination analysis. Casey Breen [3] presents a image classification using visual content for an images in sport domain. J. Haddin [4] used co-occurance based segmentation technique on feed forward Looking Infrared (FLIR) images and classify them using multilayer perceptron and shows that this method gives 95% result. Samy Sadek [5] presents a technique of Robust image classification and classifies the image into five categories i.e. ‘sky’, ‘water’, ‘Grass’, ‘soil’ and ‘urbon’ and extract a feature using wavelet decomposition. They used a test set containing 200 images 75% for training and 25% for testing. S. Park [6], extracts features using region segmentation technique. After that classifies them using back propogation algorithm Neural Network classifier. They tested with 300 training data images and 300 test data composed of 10 images from each 30 class and shows classification rates of 81.5% and 76.7% correct. N Hema Rajini [7] presents a new approach for classification of MRI brain images.

They extracts features using DWT and classify them using nearest neighbour and Artificial Neural Networks. They got classification with a success of 90% and 99% by FPNN and KNN. W. JinWel, W. Ling [8] used a three layer perceptron of neural network, they used Zernike Moment to extract image features. They shows classification for images without noise is 100% and signal to noise ratio down to 12dB classification accuracy is still 95%. V. DeBrunner, M. Kadiyala [9], describes an algorithm for classification of texture using wavelet transform. The performance of their classifier is better than Tree- Structured Wavelet Transform. S. Arirazgan, L. Ganesan [10] describes an algorithm for classifying color images using wavelet transform. They used statistical structure and spectral properties of texture. Yang Zhang and Muwei Jain [11] compares two method for texture image classification that is 1) Perceptual texture feature 2) Gabor wavelet features for testing. They used Brodatz texture database and shows experimentally second method gives more accurate results. Y. Zhang and M. Jain [12] compares two method for texture image classification that is 1) perceptual texture feature 2) Gabor wavelet features. For testing for that they used Brodatz texture database and shows experimentally second method gives more accurate results. P. Hiremath, S. Shivshankar [13] proposed a texture classification of digital images based on co-occurrence features obtained from two level wavelet packet decomposition. Classification accuracy rates are compared with that of one level wavelet decomposition and two level pyramid decomposition and result are found to be improved.

In this paper, we decompose images by applying Daubechie 2 wavelet and extracted features of images. Then decomposed image further decomposes up to 4th level extracted features. The classification result obtained by applying features to neural network.

Artificial Neural Networks

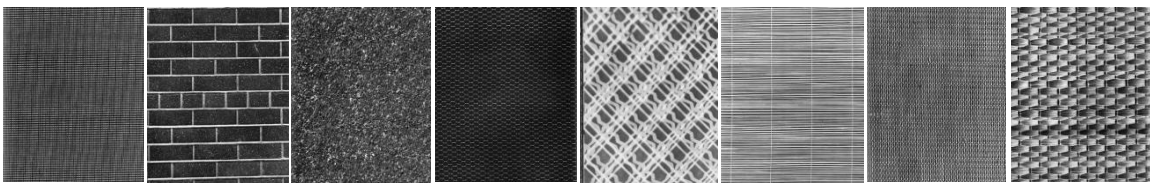
Artificial Neural Network is nothing but a one technique in which human brain is simulated electronically. An ANN is a mathematical model consisting of a number of highly interconnected processing elements organized into layers, geometry and functionality of which have been resembled to that of the human brain. The neural networks are used as a classifier. Neural networks are trained and then tested the query images for respective classes.

Minimum Distance Classifier

In Minimum Distance Classifier the minimum distance between query image and the respective classes is calculated and according to that the images are classified in particular class. Minimum distance works well when the between mean is large compared to the randomness of each class with respect to its mean. A Euclidean distance between image pixel is calculated.

Proposed Method

In this paper we had taken eight sample images from brodatz texture album.



D21 D26 D29 D34 D46 D49 D53 D56

Figure 1: Image Samples

To get more samples the images are resize in 512*512 then each image is divided in 16 equal sub-images as shown in figure1

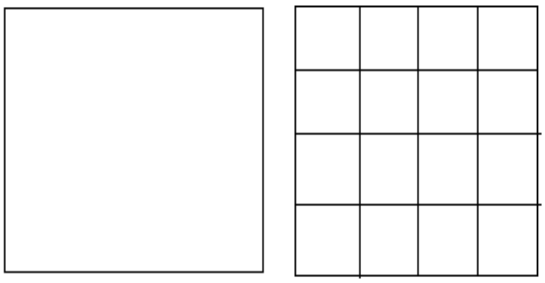
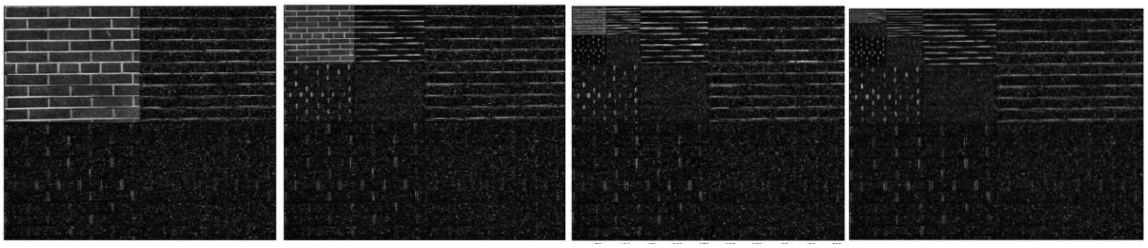


Figure 2: Image and it Equal 16 Parts

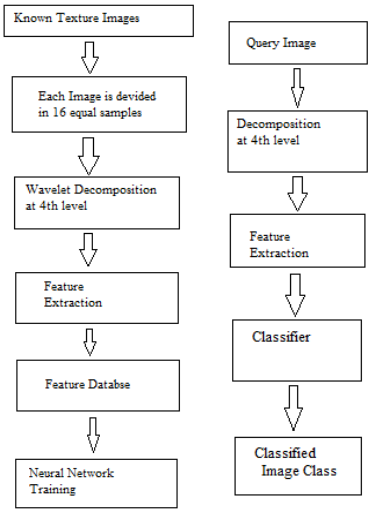
So we got 128 samples of size 128*128. Then these samples are decomposed up to 4^{th} level using Daubechie 2 as shown in figure 3 and features mean, entropy, energy and variance are extracted at fourth level. Half samples are used for training neural network and half samples are used for testing. The Overall classification rate is computed and compared with Minimum Distance classifier and also for query image for each class is computed then the result is compared with the result computed using Minimum distance classifier.



1st level 2nd level 3rd level 4th level

Figure 3: Image Decomposition

Classification Flow: There are two phases a) Training b) Testing

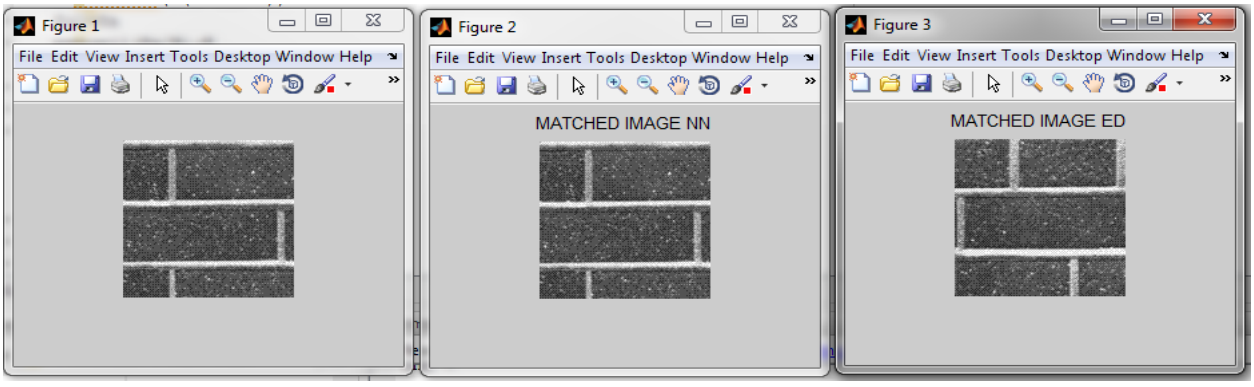


(a) **(b)**

Figure 4: Classification Flow a) Training b) Testing

RESULTS

The image samples are decomposed using db2 wavelet up to the fourth level and feature are extracted. Then the same parameters are used for neural network and Euclidean distance classifier as shown in table 1. We found that the results are better by using neural network as compared with minimum distance classifier at fourth level decomposition. The Experiment was carried out using MATLAB on computer having Intel i3 processor with 2GB RAM. The time taken by computer to process neural network was 28 sec with learning rate 0.009009. The output images are shown below figure 5.



a) Input Query Image **b) Match with Neural Network** **c) Match with Minimum Distance**

Figure 5 Compared Images

Table 1

Image Classification	D21	D26	D29	D34	D46	D49	D53	D56
Neural Network	100	100	87.5	75	87.5	75	25	37.5
Minimum Distance Classifier	87.5	100	75	62.5	75	62.5	50	75

CONCLUSIONS

This paper basically compares the two methods of classification. In both the method the sample images are taken from brodatz texture album and are decompose using db2 wavelet at fourth level to extract features. The experimental result shows that the neural network are more accurate than minimum distance classifier.

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